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Artificial Intelligence and Islam: A Bibiliometric-Thematic Analysis and Future Research Direction

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ARTICLE INFO	ABSTRACT
  	The present study examines the growing relationship between Artificial Intelligence (AI) and Islam. This analysis underscores the significance of investigating scholarly output in this field using bibliometric analysis. The study employs the Bibliometrix and Biblioshiny tools to demonstrate the diverse applications of AI in Islamic contexts and the challenges and opportunities that have arisen as a result of the COVID 19 pandemic. Furthermore, it emphasises the need for additional research to explore trends, key contributors, research themes, and future agendas in AI- Islam studies. Since the onset of the COVID 19 pandemic, there has been a noticeable shift in research focus towards AI-Islam, resulting in the emergence of four distinct niches: AI in education, Islamic banking, mobile banking, and Islamic ethics. Researchers are exploring the potential of AI tools in education, investigating the application of AI in Islamic banking, grappling with challenges and opportunities in mobile banking, and scrutinising the ethical implications of AI in the Islamic context.

1. Introduction
1.1 Research Background

Artificial Intelligence (AI) is an advanced system to imitate human cognition, memory, and emotions by incorporating them into machines, such as computers and robots. Functioning as software, AI enables computers to simulate human-like decision-making, problem-solving and predictive capabilities [1]. The objective of AI development is to explore the potential of machines to replicate human behaviour and integrate them into diverse systems, including robots, computers, cars, and other technologies, to enhance human-like intelligence. AI is increasingly relevant in the Islamic context, with applications in various aspects of human life such as computer programs, vehicles, and devices. In the field of arbitration, AI has the capacity

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to be incorporated into the dispute resolution process, bringing added value if employed appropriately [2]. AI is also utilised in Islamic financial services to support institutions in learning, decision-making, and predictive analytics. The future of AI in Islamic banks worldwide is being explored, considering its benefits, limitations, and full compatibility with Islamic law (Shariah) principles [3]. Moreover, based on the previous studies, is an excellent opportunity for a conduct bibliometric analysis of the pre and post relationship between artificial intelligence and Islam [11,13,21,24]. While quantitative measures offer perception into typical AI research, along with exponential increase in guides and patents, as well as increasing citation effect for technical subfields, there may be a paucity of research especially focused on tendencies and perspectives within Islamic contexts. This loss of studies knowledge impedes the dimension of the complex challenges and possibilities bobbing up from the integration of AI tools in Muslim-majority societies. Addressing these gaps may further contribute significantly to leveraging AI in ways that are ethically aligned with Islamic values and responsive to the unique challenges of prior and post-pandemic era, in particular.

Nonetheless, prominent religious bodies such as the Indonesian Nahdlatul Ulama Supreme Council have prohibited the use of AI in issuing fatwas or interpreting religious law, arguing that artificial tools lack qualities like wisdom and intuition granted only to qualified human muftis. Parallel policy statements recognise the benefits of AI across education, health, and science within an Islamic framework aligned with universal ethics [4]. This highlights the need for balanced perspectives informed by robust bibliometric analysis. AI encompasses different types of applications in society. Reactive machines, limited memory, theory of mind, and self-awareness are the four main types of AI. With each with its own philosophy, purpose, and technique, AI can also be further classified based on its level of technology, such as Narrow AI, Strong AI, and Superintelligent AI [5]. Practically AI techniques are applicable in diverse domains, including computer vision, natural language processing (NLP), smart buildings, smart homes, intelligent transportation, healthcare, military, and commercial products. AI is used in urban computing, sustainability, healthcare, security, justice, and other areas of smart societies. Additionally, AI plays a role in social media, mobility, and economic scenarios, and can be used to model and mitigate network effects as well as track extremist behaviour. An examination of these particular categories, coupled with an exploration of recent AI implementations, may offer valuable insights into the current state and the potential future of this transformative technology [6].

Narrow AI is particularly designed to excel in a specific assignment or a hard and fast of carefully related duties, as validated by using digital personal assistants like Apple Siri, Alexa, and Google Assistant, which use herbal language processing and system learning algorithms to understand and respond to user queries, manipulate schedules, and manage smart home gadgets [7]. Similarly, streaming systems like YouTube, Netflix and Spotify make use of Narrow AI to examine user possibilities and provide personalized content suggestions. IBM's Watson, a cognitive computing system, showcases Narrow AI in scientific analysis, remedy guidelines, and drug discovery by using analysing datasets and medical literature. On the alternative hand, General AI, additionally referred to as Strong AI, refers to an extra superior form of AI that may comprehend, examine, and follow know-how across a wide variety of obligations at a human-like level [8].

Despite being a theoretical idea, the idea of Superintelligent AI has raised tremendous ethical and existential questions due to its potential to surpass human intelligence in all dimensions. While real Superintelligent AI stays theoretical, advances in AI studies, especially in reinforcement mastering and neural network architectures, have contributed to ongoing

discussions approximately the emergence of fairly advanced AI structures like Generative Artificial Intelligence (GenAI) application, namely OpenAI's GPT- four, which showcases fantastic natural language expertise and generation capabilities within unique linguistic and contextual obstacles [1].

Moreover, using artificial intelligence (AI) in Islamic finance is an unexpectedly growing phenomenon, operating on standards along with transparency and risk sharing. AI has the ability to beautify Shariah audits and offer automation thru device studying algorithms. Furthermore, AI is being employed in numerous elements of day-by-day existence, which includes presenting solutions to queries about prayer rituals and halal food restrictions thru chatbots. However, AI is yet capable of addressing complicated prison evaluations across different Islamic schools of concept [9].

Additionally, the use of AI inside the issuance of Islamic fatwas is not universally everyday via the religious network. Religious institutions in general use AI as a marketing device, which highlights the constraints of muftis who are often seen as clerks who administer pre-decided fatwas as opposed to nicely-versed pupils.

The research of studies issues on the juncture of AI-Islam (AI-Islam) has assumed paramount significance, especially in light of the transformative results of the COVID 19 pandemic. The pandemic has no longer only multiplied the adoption of virtual technologies across numerous domain names, however has additionally engendered precise demanding situations and opportunities for the fields of AI-Islamic studies [6,10]. It is vital to scrutinise research traits in AI-Islam, both pre- and put up-COVID 19, for numerous educational reasons.

Firstly, the worldwide reaction to the COVID 19 pandemic has underscored the importance of technology, together with AI, in tackling tricky societal issues. Although the pre-pandemic landscape of AI-Islamic studies may have laid the basis for sure packages, the publish- pandemic technology warrants a re-assessment of priorities. For instance, the combination of AI into healthcare, pandemic management, and crisis response has become more salient [11]. Research on this region should cognizance on how Islamic ethics and principles align with or confront the deployment of AI technology in healthcare at some stage in times of crises.

To this moment, the contemporary body of literature on AI-Islam during and after the COVID 19 pandemic remains scant, without a particular reference to AI in any of the literature. However, a few papers discover the importance of Islamic studies in responding to the pandemic. One such paper examines the status quo of a digital Islamic society in Brunei in the course of COVID 19 via digitalization coverage tasks [8]. Another paper offers a vital evaluation of the pandemic from an Islamic perspective, analysing sacred scriptures and corresponding responses. This research underscores the importance of Islamic research and the role of faith in addressing the demanding situations posed by means of the pandemic. Despite this, the majority of publications have failed to make any direct point out of AI in relation to Islam and prior and pots COVID 19 pandemic [10].

The modern scenario is characterised by the emergence of a new paradigm of life. It is evident that for a significant component, if no longer the mass of population, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), typically referred to as COVID 19, now not poses same risks of detrimental results as it did in the course of the incipient degrees of the worldwide health crisis. The aforementioned changes have given upward thrust to a pervasive assumption propelled with the aid of political and economic exigencies that the global pandemic has receded into the annals of history. However, the cruel truth is that no one could get away the pandemic's impact. The realm of academic studies has been profoundly impacted through the global pandemic. To the best of our knowledge, no bibliometric analyses have been performed

to date concerning the intersection of COVID 19 and AI-Islam before, during, and after the pandemic [12,13].

Thus, this study objectives to bridge it by way of supplying a complete evaluate of studies on AI-Islam conducted before, during, and after the pandemic. Through rigorous analysis, a comprehensive knowledge of the ethical and realistic implications of AI in Islamic contexts can be attained, guiding policymaking and shaping the integration path of AI within rich Islamic social fabrics each earlier than and after the COVID 19 pandemic. The objective of this bibliometric-thematic analysis is to investigate the trajectory of scholarly publications in the AI Islam field by addressing five research questions and considering the state-of-the-art advancements in this rapidly evolving international field.

I. What are the current publication trends and states of AI-Islam studies?
II. What are the most highly cited publications in the AI-Islam research?
III. Who are the most prolific contributors, in terms of authors, source titles and countries, to the AI-Islam research?
IV. What are the primary keywords in the AI-Islam research?
V. What are the primary research themes in the AI-Islam field before and after COVID 19 pandemic?

2. Methodology

Bibliometric analysis is a quantitative method utilised to evaluate and analyse scholarly literature, typically in the form of academic publications, by examining the patterns of publication, citation, and co-citation. This analysis entails the application of statistical and mathematical techniques to quantify the impact and influence of research outputs within a specific field or discipline. Undertaking a thorough assessment of the methodology utilised in research publications is of paramount importance [14]. Bibliometric analysis is a well-established methodology for tracking and presenting statistical data on specific concepts or terms within the field of AI-Islam, as per academic research. This methodology involves a thorough examination and documentation of metadata information, which enables scholars to gain a deep understanding of how knowledge is disseminated and diffused to an esteemed readership. Recent bibliometric analysis performed within the other research domains have validated the effectiveness of this approach. Thus, the results of these studies demonstrate that bibliometric analysis is a also reliable method for monitoring and presenting statistical data on specific concepts or terms within the field of AI-Islam.

2.1 Defining Keywords

The importance of using appropriate keywords in conducting bibliometric reviews cannot be overstated. In order to achieve the study's objectives, the researchers utilised the primary keywords of artificial intelligence and Islam. Proficient researchers are capable of identifying a multitude of variations, relevancies, and combinations of these keywords, which serves as evidence of their deep understanding of the subject matter [14]. Therefore, in accordance with the constraints of the article's title, authors have formulated the following query and adhering to its spelling, specific terms, and phrases for the desired outcome: TITLE-ABS-KEY (Islam* OR Muslim* AND artificial AND intelligence OR AI). The utilization of the search string will yield robust results relating to the search.

2.2 Search Strategy and Data Analysis Tool

This study employs a substantial collection of published papers from the Scopus database, which encompasses a broad range of topics related to AI Islam. The researchers have selected Scopus database as the principal source of dataset due to its widely recognized status as a leading repository of documents, abstracts and citations in social sciences, technology, management and arts, among others, fields. This database is highly regarded and widely used in academic circles for its comprehensive coverage of scholarly literature in these fields [15]. Peer-reviewed articles in this database are sourced exclusively from reputable academic publishers, among others, Springer, Emerald, Elsevier, Inderscience, PubMed, and Taylor and Francis Group. These sources are widely recognized for their trustworthiness and dependability. To address the research questions at hand, this study utilises Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach in conjunction with bibliometric analysis, employing the R tool. The search strategy and bibliometric analysis steps are visually represented in Figure 1. Data remediation was carried out using the OpenRefine tool prior to analysis, ensuring that the study's results are based on a comprehensive and dependable source of information [16].

The main goal of this research is to simplify the intricate processes involved in scientific bibliometric analysis of AI-Islam research. In order to thoroughly explore the research questions aforementioned and offer a comprehensive grasp of the research objectives, the authors employed Biblioshiny, a specialized tool designed for the Bibliometrix R package, to perform an extensive bibliometric analysis [25]. Figure 2 showcases the various structured steps and thorough analyses that were conducted throughout this study. The analyses in this study are categorised descriptive analysis and network analysis, respectively.
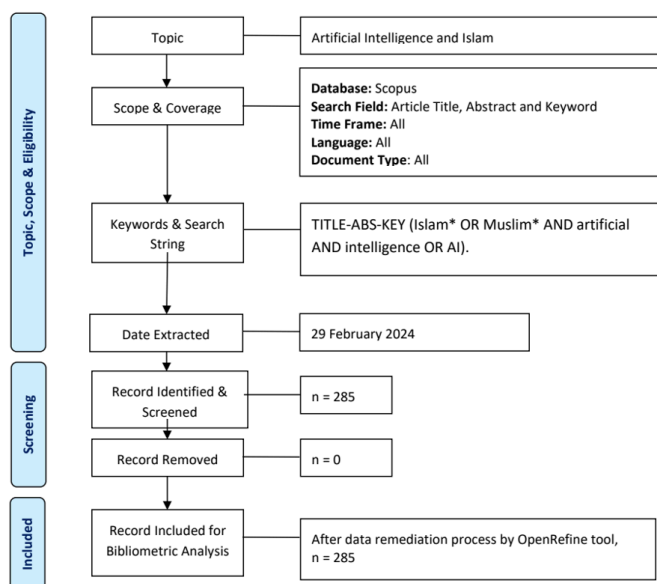

Fig. 1. Flow diagram of the search strategy adapted
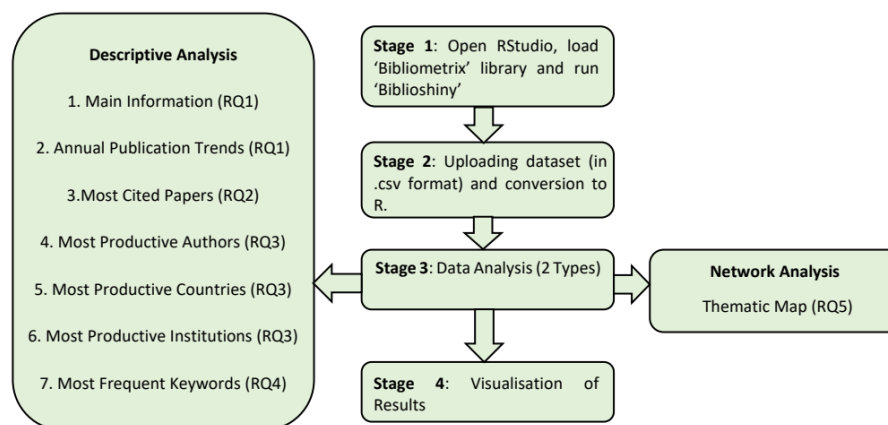from previous studies [12,17]

Fig. 2. Bibliometric analysis procedures of Bibliometrix and Biblioshiny
Sources: Authors as guided by previous study [16]

2. Results and Analysis

The following section provides an analysis of AI-Islam research profile by examining its publication sources from 1989 to 2024. This section presents a comprehensive range of data that encompasses current scholarly publications, prevailing research trends, highly cited documents, prolific authors, countries and institutions of origin, publication sources, and keywords used by the authors. Table 1 displays the outcomes obtained from the PRISMA approach to the Scopus database, which contains 285 publications published between 1989 and 2024. The corpus of scholarly publications in this field has demonstrated a significant increase, with an impressive annual growth rate of 7.6%. Table 1 reveals that 36 articles have been catalogued under the h-index and 112 under the g-index. Despite their widespread acceptance within the scholarly community as metrics for evaluating the impact and productivity of researchers, both the h-index and g-index are subject to limitations and criticisms. Table 2 presents the top 10 subject areas related to the AI-Islam field, with Computer Sciences and Social Sciences occupying the highest positions.

Table 1
Main information

Description	Main information about data	Results
Timespan	1989-2024	
Sources (Journals, book, etc)	209	
Documents	285	
Annual growth rate %	7.6	
Document average age	4.34	
Average document per doc	5.228	
References	10696	
Document contents		
Keywords plus (ID)	1525	
Authors keywords (DE)	1017	
AUTHORS		
Authors		778
Authors of single-authored docs		54
Authors collaboration		
Single-authored docs		58
Co-Authors per Doc		3.03
International co-authorship %		23.16%

Document types	
Article	120
Book	9
Book chapter	33
Conference paper	95
Conference review	15
Editorial	1
Erratum	2
Letter	1
Note	1
Review	8

Table 2
Top 10 subject areas

Subject areas	TP	%
Computer Sciences	140	0.491228
Social Sciences	66	0.231579
Engineering	62	0.217544
Business, Management and Accounting	48	0.168421
Art and Humanities	42	0.147368
Economics, Econometrics and Finance	40	0.140351
Decision Sciences	31	0.108772
Mathematics	28	0.098246
Medicine	15	0.052632
Physics and Astronomy	13	0.045614

Total publication = TP*

Table 3
Annual progress on publication of AI-Islam

Year	TP	TC	Mean TC perArt	Mean TC perYear	Citable Years	h-index	g-index
1989	1	0	0	0.00	36	0	0
2004	0	0	0	0.00	21	0	0
2006	2	10	5	0.26	19	2	2
2007	1	7	7	0.39	18	1	1
2008	6	18	3	0.18	17	2	4
2009	1	5	5	0.31	16	1	1
2010	1	26	26	1.73	15	1	1
2011	3	24	8	0.57	14	3	3
2012	5	101	20.2	1.55	13	3	5
2013	4	52	13	1.08	12	3	4
2014	8	192	24	2.18	11	5	8
2015	7	37	5.29	0.53	10	4	6
2016	8	87	10.88	1.21	9	4	8
2017	9	43	4.78	0.60	8	4	5
2018	16	62	3.88	0.55	7	5	7
2019	21	173	8.24	1.37	6	7	12
2020	34	223	6.56	1.31	5	8	14
2021	31	183	5.9	1.48	4	6	13
2022	47	177	3.77	1.26	3	6	11
2023	66	70	1.06	0.53	2	5	7
2024	13	0	0	0.00	1	4	0

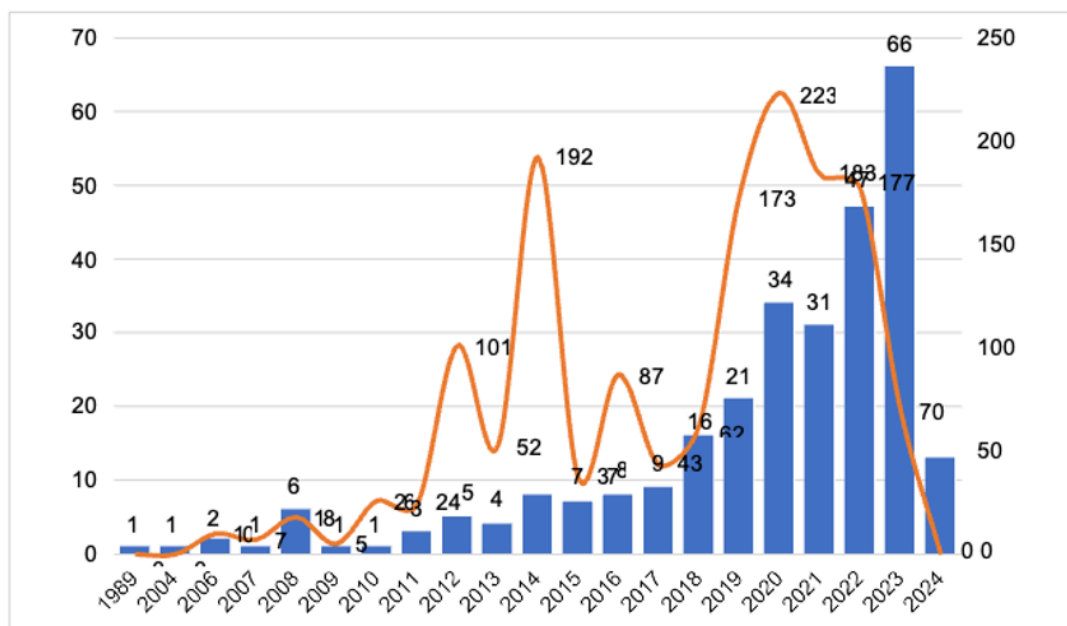Total Cittion = TC, Total Publication = TP

Fig. 3. Annual growth and publication impact

The results indicated in Table 2 and Figure 2 that publication numbers from 1989 to 2024 is 285, and the trend shows that 23.16% of them were published in 2023, which is 66 articles compared to other years. Furthermore, 34 articles were published in 2020, with highest total citation (TC) of 223. Table 3 provides a comprehensive overview of the annual progress in the publication of AI-Islam research, tracking various bibliometric indicators from 1989 to 2024. These indicators include the total number of publications (TP), total citations (TC), mean citations per article (Mean TC per Art), mean citations per year (Mean TC per Year), citable years, h-index, and g-index. Analysing this table reveals insights into the growth, impact, and influence of research in the field of AI-Islam over the years. Here's an in-depth explanation of these bibliometric indicators and what the table tells us about the AI-Islam publication landscape.

The Total Publications (TP) column shows the number of AI-Islam research papers published each year. A significant increase in publications is observed from the initial years, indicating a growing interest and development in the field. For example, only 1 publication was recorded in 1989, but by 2023, this number increased to 66 publications, highlighting an expanding research domain. Meanwhile, Total Citations (TC) column shows the total number of times all publications from a given year have been cited by other works. The increase in total citations, peaking at 223 in 2020, reflects the growing influence and recognition of AI-Islam research within the scholarly community. Mean Citations per Article (Mean TC per Art) column provides the average number of citations received per publication. High values, such as 26 citations per article in 2010 and 24 in 2014, suggest that certain publications have had significant impact, contributing to the advancement of the field.

Mean Citations per Year (Mean TC per Year) metric column averages the citations per publication per year, offering insight into the citation rate over time. The fluctuating values indicate varying levels of annual impact, with notable peaks in years like 2010, 2014, and 2021, demonstrating periods of heightened scholarly engagement with AI-Islam research. In the meantime, Citable Years column represents the number of years since publication that the work could have been cited. This factor naturally decreases for more recent publications. It's

interesting to note the relationship between citable years and the total citations, as it suggests how quickly publications are recognized and cited by the academic community.

H-Index: metric column measures both the productivity and citation impact of the publications. An h-index of 8 in 2020, for instance, means there are at least 8 papers that have been cited at least 8 times. The gradual increase in the h-index over the years indicates a solidifying research foundation and influential core of publications within the AI-Islam domain. Whereas, G-Index figures are similar to the h-index but giving more weight to highly cited articles. It is evident from the table that the g-index increases with the h-index, pointing towards a number of highly influential articles that have garnered substantial citations, thus showcasing the depth of research impact in AI-Islam.

In terms of growth trend, the steady increase in the total number of publications from 1989 to 2023 indicates an expanding interest and continuous development in AI-Islam research. The slight drop in publications and total citations in early months of 2024 might suggest a transitional period in research focus or the onset of saturation. Thus, the fluctuating mean citations per article and per year reveal varying degrees of research impact over time, with certain years marking significant breakthroughs or influential publications in the AI-Islam field.

As for the maturation of the field, growth in h-index and g-index over the years signifies the maturation of AI-Islam research, with a robust body of work that continues to be referenced and built upon by the academic community. Essentially, Table 3 encapsulates the dynamic evolution of AI-Islam research over the years, marked by growing scholarly interest, impactful contributions, and an increasingly recognized body of knowledge. This bibliometric analysis not only highlights the historical progress but also provides valuable insights into the trends, challenges, and future directions of research in AI-Islam.

Figure 3 demonstrates a rising inclination in the publication and research of AI-Islam, which underscores the increasing significance of AI in Islamic-oriented publications. This observation is consistent with the trend towards a more comprehensive understanding of the role of technology in Islamic scholarship. Identifying periods of rapid growth in publications can highlight when the AI-Islam field experienced significant advancements or increased academic interest. This might correlate with technological breakthroughs in AI or pivotal moments in global Islamic discourse. Sharp increases or peaks in the citation line would indicate years when research in the AI-Islam field was particularly impactful. These periods may align with the publication of seminal works or when the research addressed highly relevant or emerging issues. Observing how closely the trends in publications and citations align can offer insights into the field's maturity and the ongoing relevance of its research output. A lag between publication peaks and citation peaks is typical, as it takes time for research to be disseminated and cited.

According to Table 4, Saudi Arabia, Indonesia, and Malaysia lead the way in terms of productivity in AI-Islam publications. This table provides valuable insights into the global landscape of AI-Islam publications, revealing both the leading nations in this interdisciplinary field and the emerging trends in research productivity. The contributions from a diverse set of countries highlight the universal interest in exploring the intersections between AI technologies and Islamic studies. This analysis not only sheds light on the current state of AI-Islam research but also sets the stage for future collaborations and innovations at the nexus of technology and religion. The geographical diversity among the top 10 contributing countries highlights the global interest in the convergence of AI and Islamic studies. This diversity not only underscores the universal relevance of AI technologies but also illustrates the varied applications and implications of these technologies in different Islamic cultural contexts. The leadership of countries like Saudi Arabia, Indonesia, and Malaysia emphasizes the strategic importance placed on AI within the Islamic world. These countries are leveraging AI to enhance religious education, finance, and

legal systems, aligning technological advancements with Islamic values and principles. The presence of countries like the United Kingdom and China among the top contributors showcases the interdisciplinary and cross-cultural nature of AI-Islam research. It points towards a collaborative international research landscape where technological and religious perspectives are integrated to address complex societal challenges.

Table 4
Top 10 countries productivity on AI-Islam Publications

Country	Articles	%
Saudi Arabia	21	7.4%
Indonesia	18	6.3%
Malaysia	18	6.3%
Pakistan	11	3.9%
United Kingdom	9	3.2%
Iran	8	2.8%
China	6	2.1%
Qatar	6	2.1%
United Arab Emirates	6	2.1%
Jordan	5	1.8%

Table 5
Top 15 highly cited authors and articles

No	Author (s)	Tittle	Source tittle	TC	C/Y
1	Emamgholizadeh S.; Kashi H.; Marofpoor I.; Zalaghi E. [26]	Prediction of water quality parameters of Karoon River (Iran) by artificial intelligence -based models	International Journal of Environmental Science and Technology	128	11.64
2	Abid A.; Farooqi M.; Zhou J. [27]	Persistent Anti-Muslim Bias in Large Language Models	AIES 2021 – Proceedings of the 2021 AAA1/ACM Conference on AI, Ethics, and Society	76	19.00
3	Syed M. H.; Khan S.;Rabbani M. R.; Thalassinos Y.E. [28]	An artificial intelligence and NLP based Islamic FinTech model combining zakat and Qardh-Al-Hasan for countering the adverse impact of COVID 19 on SMEs and individuals	International Journal of Economics and Business Administration	69	13.80
4	Xu L.; Cai C. B.; Cui H.F.; Ye Z.H.; Yu X.P. [29]	Rapid discrimination of pork in Halal and non- halal Chinese ham sausages by Fourier transform infrared (FTIR) spectroscopy and chemometrics	Meat Science	60	4.62
5	Saloot M. A.; Idris N.; Mahmud R.; Ja'afar S.; Thorleuchter D.;Gani A. [30]	Hadith data mining and classification: a comparative analysis	Artificial Intelligence Review	49	5.44
6	Chandra G. R.; Liaqiat I.A.; Sharma B. [31]	Blockchain Redefining: The Halal Food Sector	Proceedings – 2019 Amity International Conference on Artificial Intelligence, AICAI 2019	44	7.33

7	Imani M.; You R.-J.;Kuo C.-Y. [32]	Caspian Sea level prediction using satellite altimetry by artificial neutral networks	International Journal of Environmental Science and Technology	38	3.45
8	Shambour M.K.; Gutub A. [33]	Progress of IoT Research Technologies and Applications Serving Hajj and Umrah	Arabian Journal for Science and Engineering	36	12.00
9	Moosavi A.A.; Sepaskhah A. [34]	Artificial neutral networks for predicting unsaturated soil hydraulics characteristics at different applied tensions	Archieves of Agronomy and Soil	30	2.31
10	Yaseen S.; Al-Habaibeh A.; Su D.; Otham F. [35]	Real-time crowd density mapping using a novel sensory fusion model of infrared and visual systems	Safety Science	28	2.33
11	Muhammad W.M.; Muhammad R.; Muhammad A.; Martinez-Enriquez A.M. [36]	Voice content matching system for Quran readers	Proceedings of Special Session – 9th Mexican International Conference on Artificial Intelligence: Advanced Artificial Intelligence and Applications, MICAI 2010	26	1.78
12	Atif M.; Hassan M.K Rabbani M. R.; Khan S. [37]	Islamic FinTech: The digital transformation bringing sustainability to Islamic finance	Covid 19 and Islamic Social Finance	23	5.75
13	Macdonald S.; Correia S.G.; Watkin A.-L. [38]	Regulating terrorist content on social media: Automation and the rule of law	International Journal of Law in context	22	3.67
14	Elhadd T.; Mall R.; Bashir M.; Palotti J.;Fernandez-Luque L.;Farooq F.;Mohaniadi D.A.; Dabbous Z.; Malik R.A.;Abou-Samra A.B [39]	Artificial intelligence (AI) based machine learning models predict glucose variability hypoglycemia risk in patients with type 2 diabetes on a multiple drug regimen who fast during Ramadan (The PROFAST-IT Ramadan study)	Diabetes Research and Clinical Practices	21	4.20
15	Munawar HS.; Inam H., Ullah F.; Qayyum S.;Kouzani A.Z.;Mahmud M.A.P [40]	Towards smart healthcare: UAV based optimized path planning for delivering Covid 19 self-testing kits using cutting edges technologies	Sustainabilty (Switzerland)	21	5.25

Figure 4 illustrates the trends of single-author and multi-author documents on AI Islam. It shows an upward trend in multi-author documents throughout the publication years. This indicates that AI Islam is a multidisciplinary domain which entails extensive cooperation among authors. Meanwhile Table 5 delineates the top 15 highly cited authors and articles within the AI and Islam publications landscape, showcasing the pivotal contributions to this interdisciplinary field. The table is structured to provide a comprehensive snapshot of impactful research, including authorship, article title, source title, total citations (TC), and citations per year (C/Y), allowing for an analysis of both the immediate and enduring influence of these works. Table 5 highlights a broad spectrum of research themes, from environmental science and technology applications to

ethical considerations of AI, indicating the interdisciplinary nature of AI-Islam research. For instance, the top-cited article by authors in study [26] focuses on the prediction of water quality parameters using AI models, while researchers in study [27] address anti-Muslim bias in large language models, showcasing the range of applications and concerns at the intersection of AI and Islam.

The citation counts serve as a testament to the articles' influence and relevance within the academic community. High citation counts, such as 128 for article [26] and 76 for article [27], reflect the significant impact these studies have had in advancing the field and engaging with broader scholarly discussions. The Citations Per Year (C/Y) metric offers insight into the sustained relevance of the research over time. The high C/Y for the [27] study at 19.00 underscores the timely and pressing nature of the issues addressed, particularly in the context of AI ethics. Conversely, the enduring influence of [26] study with a C/Y of 11.64 over a longer period underscores the foundational importance of their work in AI applications to environmental science.

Furthermore, the variety of source titles, ranging from "International Journal of Environmental Science and Technology" to "Proceedings of the 2021 AAAI/ACM Conference on AI Ethics and Society," highlights the interdisciplinary appeal and application of AI-Islam research. This diversity underscores the field's role in bridging technological innovation with ethical, environmental, and societal considerations from an Islamic perspective. Several articles demonstrate innovative applications of AI in addressing specific challenges relevant to the Islamic world. For example, authors in study [28] propose an AI and NLP-based Islamic FinTech model to mitigate COVID 19's adverse effects on small and medium enterprises and individuals, while researchers in study [31] explore blockchain technology's potential in redefining the halal food sector. The top 15 highly cited authors and articles in AI and Islam publications illustrate the dynamic and multifaceted nature of this research area. The listed works not only contribute significantly to their respective fields but also encourage ongoing dialogue and exploration at the intersection of technological innovation and Islamic values. This bibliometric snapshot serves as a valuable reference point for researchers, policymakers, and practitioners interested in the ethical, societal, and technological implications of AI within the context of Islam, highlighting key contributions and trends that shape this evolving interdisciplinary field.
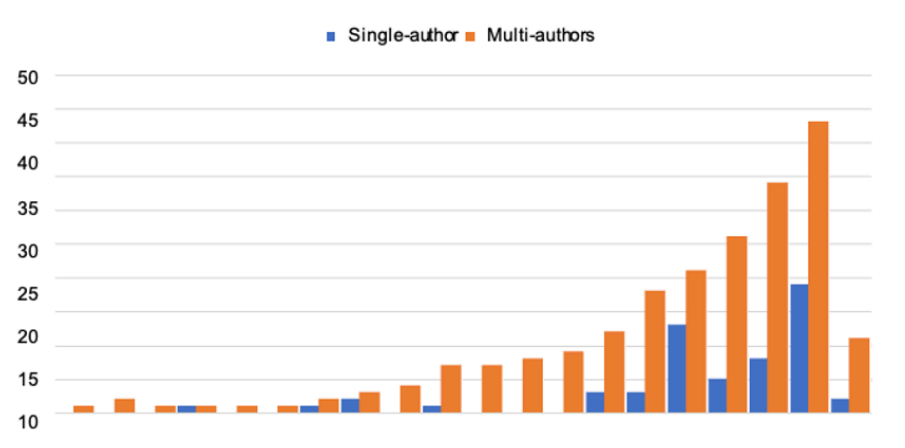

Fig. 4. Trend of single -author documents and multi-author documents

In the analysis, the researchers conducted a thorough examination of the predominant methodologies employed within AI-Islam research domain. The aim was to execute a relative assessment to clarify the diverse methodologies prevalently applied in this field. Table 6, as delineated in the study, offers an exhaustive summary of the keywords most frequently utilised, accompanied by their respective keyword lists. This table delineates both the indexed keywords and authors' keywords of the publications, highlighting that these keywords were mentioned on more than two occasions.

Table 6
Top keywords

Author's keywords	Occurrences	Indexed keywords	Occurrences
Artificial intelligence	67	Artificial intelligence	101
Machine learning	17	Learning system	19
Islam	14	Human	14
Fintech	12	Islam	14
Islamic Finance	11	Deep learning	13
Deep learning	9	Decision making	12
Terrorism	6	Decision support systems	12
Zakat	6	Female	12
Covid 19	5	Article	11
Information retrieval	5	Classification (of information)	11

Figures 5 and Figure 6 present thematic visualisations corresponding to periods prior and post COVID 19 pandemic, correspondingly. Figure 5 illustrates the geographical distribution of thematic concerns prior to the pandemic, highlighting themes of significant centrality and density that are widely recognized and thoroughly explored within the existing scholarly discourse, thereby constituting the core of research in the AI-Islam domain. This period's research primarily focused on three distinct niche areas: Islamic banking, data mining, and hadith classification. Conversely, Figure 6 delineates the post-pandemic spatial organization of niche thematic elements related to AI-Islam, signifying the evolution of AI-Islam as a paramount and comprehensive subject of inquiry in contemporary research. The incorporation of artificial intelligence within fields such as education, Islamic banking, mobile banking, and Islamic ethics denotes the emergent themes. Depicted in the lower left quadrant of Figure 6, the shift indicates emerging trend within the discipline, embarking upon novel AI-Islam research avenues.
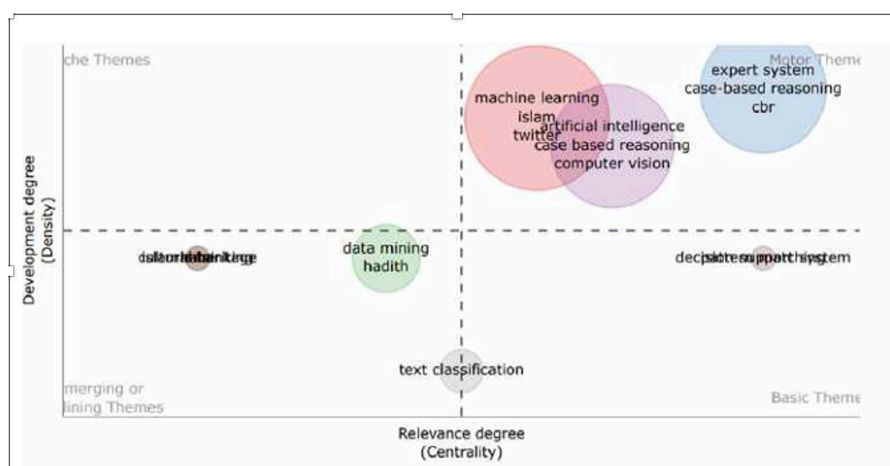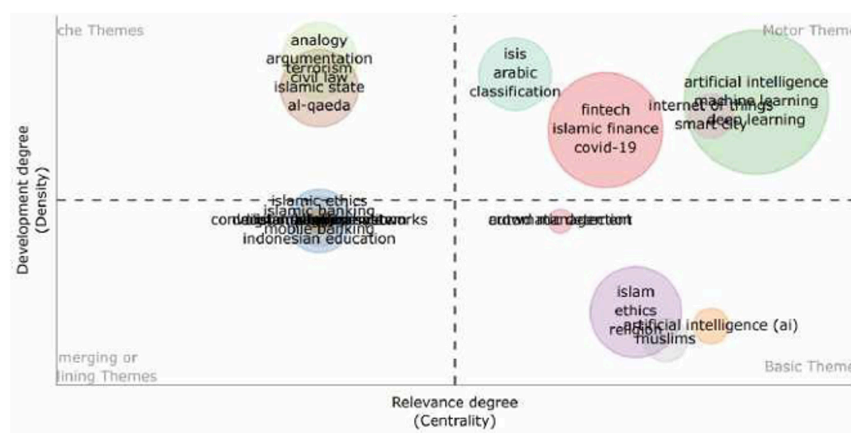

Fig.5. Pre- pandemic themes

Fig. 6. Post-pandemic themes

The application of bibliometric analysis in the fields of Islam and AI, with a particular emphasis on AI in education, Islamic banking, mobile banking, and Islamic ethics, holds significant implications for academic research, policymaking, and practical applications. The growth in publications and citations in these areas demonstrates the increasing academic interest in the intersection of AI-Islam principles. In the field of AI in education, bibliometric patterns emphasize the need for collaborative efforts in educational technology research to enhance Islamic pedagogy through the use of technology [18]. The discourse surrounding the ethical integration of AI in Islamic finance, as indicated by bibliometric trends in Islamic banking, highlights the need for policymakers and financial institutions to align technological advancements with the principles of Islamic finance. Mobile banking, as reflected in bibliometric data, is an emerging area of interest, suggesting the need for further research into the ethical, regulatory, and technological dimensions of AI driven mobile financial services in Islamic societies. The bibliometric analysis of Islamic ethics in AI reveals a growing awareness of ethical considerations advocating for responsible AI development within the context of Islamic values [19]. Thus, the implications of bibliometric analyses highlight the evolving landscape of AI within the Islamic domain, guiding researchers, policymakers, and practitioners towards informed decisions and collaborative initiatives that navigate the intersection of technology and Islamic principles in education, finance, mobile services, and ethical considerations.

The post COVID 19 era has witnessed a significant shift in research focus within the realms of AI- Islam, resulting in the emergence of four distinct niches: AI in education, Islamic banking, mobile banking, and Islamic ethics. This synthesis provides a critical examination of the scholarly landscape, highlighting the relevance and interconnectivity of these niches in the context of the ongoing digital transformation. The accelerated adoption of technology in education post-pandemic has propelled AI to the forefront of educational research, particularly within the Islamic sphere [18]. Scholars are increasingly exploring the integration of AI tools and platforms to enhance the quality and accessibility of Islamic education, ensuring alignment with traditional values while adapting to the demands of the digital age. The pandemic has also catalysed a profound evolution in Islamic banking, where the ethical principles of Shariah law intersect with the efficiency and innovation offered by AI [20]. Researchers are actively investigating how AI can be harnessed to streamline processes, mitigate risks, and enhance customer experience within the unique framework of Islamic finance. Moreover, the surge in mobile technology usage, especially in Muslim-majority regions, has led to the emergence of mobile banking as a critical niche within AI-Islam research. Scholars are delving into the challenges and opportunities presented by AI-powered mobile banking, ensuring that these

innovations comply with Shariah principles while addressing issues related to interest and financial inclusion [4,19,21]. Simultaneously, the ethical implications of AI applications within the Islamic context have become a central focus of research [4]. As AI systems have become more sophisticated, the need to align these technologies with Islamic ethical principles has gained prominence.

Researchers have thoroughly investigated the ethical considerations of AI across various sectors, including healthcare, finance, and education, in order to determine how these technologies can be developed and implemented in a manner that aligns with Islamic ethics and moral values. Collectively, these four emerging fields form a comprehensive research agenda in the AI-Islam domain post-COVID 19 [22]. The growing reliance on digital technologies and the need to adapt to a rapidly changing landscape emphasize the timeliness and significance of these research trajectories. The interconnectedness of these fields adds a layer of complexity and richness to the research landscape, highlighting the holistic nature of the intersection between AI-Islamic studies [23]. The practical relevance of these fields is evident in the global interest in Islamic finance, the widespread adoption of technology in education, and the increasing prevalence of mobile banking in Muslim majority regions [20]. As AI continues to transform industries and societies, it is essential for scholars, policymakers, and practitioners to understand its implications and applications within an Islamic context.

4.1 Future Research Direction

This study offers comprehensive insights into the growth and trends of AI Islam. However, this is not without its limitations. First, bibliometric analyses primarily focus on quantitative metrics such as publication counts and citation analysis, which may overlook the qualitative depth and theoretical contributions of individual works. As a result, this emphasis on quantifiable data may not fully capture the nuanced debates, conceptual frameworks, and interdisciplinary approaches that characterise the field. Moreover, the use of single database such as Scopus to source publications introduces a selection bias, as not all relevant research might be indexed in this database. Consequently, important contributions published in lesser-known journals, books, or languages other than English may be underrepresented or omitted entirely, skewing the analysis towards a partial view of the field. This limitation could lead to an incomplete understanding of the global discourse on AI and Islam, particularly in regions or linguistic groups that are less represented in major academic databases. Additionally, the rapid evolution of both AI technologies and Islamic ethical considerations means that the research landscape is constantly shifting. Bibliometric analyses, by their nature, may lag behind the latest developments and emerging themes that have not yet crystallised into a significant body of publications. Therefore, while bibliometric analysis serves as a valuable tool for mapping scholarly territory, it should be complemented with qualitative reviews and forward-looking discussions to grasp the full spectrum of AI-Islam intersections, including the ethical, legal, and societal implications that might not yet be fully reflected in the literature.

Nevertheless. the synthesis of the emerging niches not only reflects the current state of AI-Islam research, but also sets the stage for future agenda, positioning scholars to meaningfully contribute to the ethical, cultural, and technological dimensions of AI within Islamic societies. Briefly, the post-COVID 19 era catalysed a paradigm shift in AI-Islam research, with AI in education, Islamic banking, mobile banking, and Islamic ethics emerging as critical and interconnected niches. This synthesis provides a comprehensive overview of the current research landscape, highlighting the relevance and significance of each niche, while emphasising the need for a holistic understanding of the evolving intersection between AI-Islam. The exploration of these emerging niches not only responds

to the challenges and opportunities presented by the digital age, but also lays the foundation for a nuanced and impactful research agenda that contributes to the ethical and sustainable development of AI within Islamic contexts. In other words, the integration and examination of these nascent areas within the domain of AI-Islam research not only encapsulate the present scholarly landscape but also herald an upcoming scholarly agenda. This future agenda is poised to significantly impact the ethical, cultural, and technological facets of artificial intelligence as it interfaces with Islamic communities. In essence, the post-COVID 19 period has been a catalyst for a profound shift within the AI-Islam scholarly discourse.

Areas such as AI applications in education, Islamic financial systems including banking and fintech, alongside Islamic ethical frameworks, have crystallized as pivotal and interlinked domains of inquiry. This comprehensive synthesis elucidates the current state of research, underscoring the pertinence and criticality of each identified niche, while advocating for a comprehensive grasp of the dynamic interplay between AI and Islam. The rigorous exploration of these nascent areas not only addresses the unique set of challenges and prospects ushered in by the digital era but also establishes a robust and insightful research trajectory. This trajectory is instrumental in fostering an ethical and sustainable integration of AI technologies within Islamic socio-cultural contexts, thereby contributing meaningfully to the broader discourse on technological advancement and religious adherence.

4.1 Recommendations for Researchers, Policymakers, and Practitioners

When exploring the complex intertwining of Islam and AI in the domains of education, Islamic finance, mobile banking, and ethics, a few pivotal suggestions stand out. Academicians should encourage cross-disciplinary partnerships to broaden the comprehension of AI's effects on Islamic education, making sure that tech complements cultural and religious principles. Pushing for long-term studies and factual research is fundamental to keep up with the changing panorama, offering a factual knowledge base for decision-makers [6,19].

It is crucial for decision-makers to cooperate with researchers for shaping frameworks that govern AI implementation in Islamic finance. This process entails formulating guidelines that respect Shariah values and simultaneously encourage breakthroughs in fintech. Joining forces with international organizations and academics is essential to align standards throughout various regions with a high Muslim population [24].

Mobile banking professionals need to spotlight on enlightening users about the AI powered services and abide by ethical principles rooted in Islamic finance. Also, it is imperative for financial organisations and technology creators to join forces to tackle issues concerning interest and inclusivity, making sure mobile banking aligns with the Islamic financial values. Upholding ethics in AI requires worldwide standards, and professionals in various fields should focus on the formulation and observance of ethical norms [3,13]. Ongoing discussions among researchers, policymakers, and professionals are crucial in evolving a thorough comprehension of the ethical facets distinct to the conjunction of Islam and AI. Being transparent and accountable in the development and implementation of AI solutions is integral for establishing trust within Islamic societies and beyond.

5. Conclusions

In this comprehensive bibliometric analysis, it is evident that the intersection of AI and Islam is a thriving and rapidly expanding field of scholarly inquiry. This study has meticulously mapped the evolving landscape of AI-Islam research, highlighting the diverse applications of AI in Islamic

contexts and delineating the myriad challenges and opportunities that have emerged, particularly in light of the COVID 19 pandemic. The pandemic has served as a catalyst, driving a noticeable shift in research trajectories towards exploring AI's potential across four key emerging niches: education, Islamic banking, mobile banking, and ethical considerations within an Islamic framework. The examination of AI tools in educational settings, the integration of AI into Islamic financial systems, the analysis of mobile banking innovations, and the critical evaluation of AI's ethical dimensions in Islamic contexts collectively underscore a dynamic and fertile area of research. These domains not only reflect the immediate response to contemporary challenges but also signal the broader, ongoing discourse surrounding the ethical and sustainable deployment of AI technologies in alignment with Islamic principles and values. The analysis calls for a deeper and continued exploration of these emergent themes, urging scholars to delve further into the trends, key contributors, and overarching research themes that define the AI-Islam nexus. By doing so, it aspires to pave the way for a nuanced, impactful, and future-oriented research agenda that bridges AI innovation with the rich tapestry of Islamic cultural and ethical considerations. This bibliometric study not only elucidates the current state of AI-Islam research but also serves as a clarion call for scholarly engagement with the ethical, cultural, and technological implications of AI within Islamic societies. As such, it lays the groundwork for future scholarly endeavors that are poised to significantly contribute to the discourse on AI and religion, offering vital insights that are crucial for navigating the complexities of the digital age within the framework of Islamic ethics and principles.

Acknowledgement

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